

SECTION 05100
STRUCTURAL STEEL

PART 1 - GENERAL

0.1 DESCRIPTION OF WORK

- A.** Work Included: This Section specifies the following items.
 1. Structural steel.
 2. Architecturally exposed structural steel.
- B.** Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 1. Section 04800 - MASONRY: Anchor sections of adjustable masonry anchors for connecting to structural frame.
- C.** Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 1. Section 03300 - CAST-IN-PLACE CONCRETE: Lintels, sleeves, anchors, inserts, embedded wall plates, loose leveling plates and similar items.
- D.** Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 1. Section 09900 - PAINTING: Finish painting of exposed structural steel.

0.2 DEFINITIONS

- A.** Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges", that support design loads.
- B.** Architecturally Exposed Structural Steel: Structural steel that forms a prominent architectural feature in a building or structure or designated as architecturally exposed structural steel on the Drawings.

0.3 PERFORMANCE REQUIREMENTS

- A.** Connections: Provide details of connections required by the Contract Documents to be selected or completed by the structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using the American Institute of Steel Construction's (AISC) "Manual of Steel Construction, Load and Resistance Factor Design", Volume 2, Part 9.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

0.4 SUBMITTALS

- A. Product Data:** For each type of product indicated.
- B. Shop Drawings:** Show fabrication of structural-steel components.
 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Include embedment drawings.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld.
 4. Indicate type, size and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding Certificates:** Certificate from AWS indicating certification in type of welding required for each welder and welding operator.
- D. Welding Records and Data:**
 1. Before welding, submit the procedure which will be used for qualifying welders and welding procedures. For procedures other than those pre-qualified in accordance with AWS D1.1, submit a copy of procedure qualification test records.
 2. Submit certified copy of qualification test records for each welder, welding operator, and tacker who will be employed in the work.
 3. If field welding is permitted, submit descriptive data for field welding equipment.
 4. Submit all NDE records (radiographs, ultrasonic, magnetic particle) and visual inspection reports upon completion or when otherwise requested by the Engineer.
- E. Qualification Data:** For installer, fabricator, professional engineer, testing agency, welding inspectors, NDE inspectors and galvanizer. Submit prior to starting work.
- F. Mill Test Reports:** Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

0.5 QUALITY ASSURANCE

- A.** Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is certified for: Steel Building Structures (STD); or Simple Steel Bridge Structures (SBD); or Major Steel Bridges (CBR) as applicable
- B.** Galvanizer Qualifications: Engage the services of a qualified galvanizer who has demonstrated a minimum of five years experience in the successful application of galvanized coatings specified in this Section in the facility where the work is to be performed and who will apply the coatings within the same facility.
- C.** Installer Qualifications: A qualified installer with previous experience in installing structural steel.
- D.** Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"
- E.** Comply with applicable provisions of the following specifications and documents:
 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges"
 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2"
 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" and "Load and Resistance Factor Design Specification for Structural Steel Buildings"
 4. AISC's "Specification for the Design of Steel Hollow Structural Sections"
 5. AISC's "Specification for Allowable Stress Design of Single-Angle Members" and "Specification for Load and Resistance Factor Design of Single-Angle Members"
 6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts"
- F.** Tests and Inspection

1. The Contractor will test and inspect high-strength bolted connections and welded connections and prepare test reports. Specialty tests shall be performed at no expense to the Authority by an independent testing laboratory approved by the Engineer. Costs of specialty tests shall be borne by the Contractor. Test reports shall be submitted to the Engineer for approval.
2. The Engineer reserves the right to inspect high-strength bolted connections and weld connections. Provide access to places where structural steel work is being fabricated or erected so that required inspection and testing can be accomplished at no change in Contract Price. At times, inspection may require moving or handling of steel to permit proper inspection. Notify Materials Testing Laboratory not less than 48 hours prior to start of fabrication.
3. The Engineer may inspect structural steel at the plant before shipment; however, the Engineer reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.
4. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements at the Contractor's expense. Perform additional tests, at no expense to the Authority, as may be necessary to reconfirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.
5. Specialty Tests: Nondestructive examination of welds in accordance with provisions of AWS D1.1 and ASTM Standards noted shall be made in accordance with the following schedule:
 - a. Radiographic Examination of Welds, per ASTM E94 and E142:
 - 1) Field, complete joint penetration groove welds:
 - a) 1 out of 5 (20 percent) with thickness equal to or less than 3/4 inch.
 - b) 100 percent with thickness greater than 3/4 inch.
 - 2) Shop, complete joint penetration groove welds:
 - a) 1 out of 10 (10 percent) with thickness equal to or less than 3/4 inch.
 - b) 1 out of 2 (50 percent) with thickness greater than 3/4 inch and equal to or less than 1-1/2 inches.
 - c) 100 percent for thickness greater than 1-1/2 inches.
 - b. Ultrasonic Examination, per ASTM E164: Complete joint penetration groove butt welds not accessible for radiographic examination shall be subjected to ultrasonic testing. The extent shall be the same as noted for radiographic examination. Ultrasonic examination shall be made 48 to 72 hours after welding at locations on weldments or welded joints subject to high restraint as indicated in order to check for lameller tearing. The exact location of the areas to be inspected shall be determined with the Engineer at the time of fabrication. This examination shall be made according to the following schedule

unless conditions of tearing require a greater number of tests, as directed:

- 1) 1 out of 10 (10 percent) for thickness equal to or less than 3/4 inch.
- 2) 1 out of 5 (20 percent) for thickness greater than 3/4 inch and equal to or less than 1-1/4 inches.
- 3) 1 out of 2 (50 percent) for thickness greater than 1-1/4 inches.

- c. Magnetic Particle Examination, per ASTM E709, field and shop:
 - 1) 1 out of 5 (20 percent) of complete joint penetration groove welds of tee and corner joints.
 - 2) 1 out of 10 (10 percent) of partial joint penetration groove and fillet welds.
- d. Penetrant Examination, per ASTM E165: Shall be used for detecting discontinuities that are open to the surface use as appropriate.

6. Visual Examination: All welds whether otherwise examined or not shall be visually examined and faulty joints shall be marked for correction.
7. When any testing, examination or inspection reveals faulty welds, all joints of the same type shall be checked at no expense to the Authority until the integrity of the weld is assured before resuming examination.
8. After faulty welds have been corrected or repaired, they shall each be re-examined at no expense to the Authority in the manner specified for the original joint.
9. It is intended that inspections shall be performed to permit an orderly flow of completed material from the shop. Work with the Engineer to establish a schedule that will permit this.
10. Test result information shall be forwarded to the Engineer immediately after test results are available stating the acceptance or rejection of fabricated pieces in order that the repairs and re-inspection may be made as soon as possible.

G. Pre-Installation Conference: Contractor shall schedule a meeting to be attended by Contractor, Engineer, fabricator and galvanizer. Agenda shall include the following: Project schedule, source for each fabrication, coordination between fabricator and galvanizer and adjacent Work, finish of surfaces, application of coatings, submittals, and approvals.

0.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

0.7 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

PART 2 - PRODUCTS

0.1 STRUCTURAL-STEEL MATERIALS

A. Channels, Angles, M-Shapes, S-Shapes, W-Shapes: ASTM A 572, Grade 50.

B. Plate and Bar: ASTM A 572/A 572M, Grade 50.

C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

E. Medium-Strength Steel Castings: ASTM A 27, Grade 65-35 carbon steel.

F. High-Strength Steel Castings: ASTM A 148, Grade 80-50, carbon or alloy steel.

G. Welding Electrodes: Comply with AWS requirements.

0.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153, Class C.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers. Finish, mechanically deposited zinc coating, ASTM B 695, Class 50.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

- D.** Anchor Rods: ASTM F 1554, grade as applicable, hot-dip zinc coating, ASTM A 153, Class C.
- E.** Threaded Rods: ASTM A 193, grade as applicable, hot-dip zinc coating, ASTM A 153, Class C.
- F.** Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.
- G.** Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

0.3 MISCELLANEOUS MATERIALS

- A.** Galvanizing Repair Paint: Coatings meeting requirements of ASTM A 780.
- B.** Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

0.4 FABRICATION

- A.** Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B.** Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C.** Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D.** Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

- E.** Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F.** Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G.** Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H.** Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches o.c., unless otherwise indicated.
- I.** Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

0.5 SHOP CONNECTIONS

- A.** High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B.** Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work. Complete welds in accordance with the Contract Drawings.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 3. Insufficient welds shall be rejected and corrected until required profiles are met.

4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
5. No skip welds will be permitted for steel connections to be coated.

0.6 STEEL PRIMERS AND FINISHES

- A. Preparation for Shop Priming:** Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for The Society for Protective Coatings (SSPC) surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 10/NACE No. 2, "Near White Metal Blast Cleaning"
 2. Interiors (SSPC Zone 1A): SSPC-SP 6, "Commercial Blast Cleaning"
 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
 4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel" for shop painting.
 5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages"
- B. Zinc-Rich Primer:** Urethane zinc rich primer compatible with topcoat Specified in Section 09900. Provide primer with a VOC content of 340 g/L (2.8 lb/gal.) or less per OTC ozone standards. Provide Tnemec Series 394 or Ameron 5105 or equal by DuPont or CarboLine for exposed steel to be fireproofed, or Tnemec Series 901K97 Series or 90-97 or Ameron 68HS or equal by DuPont or CarboLine for exposed steel to be finish painted at 3.0 mils DFT.
- C. Primer for Exposed Steel to Receive Multi-Coat Shop-Applied Coating:** Tnemec Series 901K97 or 90-97 urethane zinc rich primer at 3.0 to 3.5 mils DFT, topcoated in shop with Tnemec Series V73 Endura-Shield, or use Ameron Series 68HS Primer at 3.0 to 5.0 mils DFT topcoated in shop with Ameron's Amercoat 450H, or use or equal primers and finish coats from DuPont or CarboLine.
- D. Galvanizing:** For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards. The

galvanizing bath shall contain high grade zinc and other earthly materials. Fill vent holes and grind smooth after galvanizing.

E. Hot-Dip Galvanizing And Factory-Applied Primer for Steel: Provide hot-dip galvanizing and factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and Commonwealth of Massachusetts requirements. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria:

1. Abrasion: ASTM D 4060, CS17 Wheel, 1,000 gram load.
2. Adhesion: ASTM D 3359, Method B, 5 mm crosshatch.
3. Humidity Resistance: ASTM D 4585.
4. Salt Spray (Fog): ASTM B 117.

F. Hot-Dip Galvanizing and Factory-Applied Urethane Primer and Finish for Steel: Provide factory-applied architectural coating over primed hot-dip galvanized steel matching approved samples.

1. Primer coat shall be factory-applied polyamide epoxy primer. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
2. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer.
3. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
4. Apply the galvanizing, primer and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
5. Blast cleaning of the galvanized surface is not acceptable.
6. Primer shall meet or exceed the following performance criteria:
 - a. Abrasion: ASTM D 4060, CS17 Wheel, 1,000 gram load.
 - b. Adhesion: ASTM D 3359, Method B, 5 mm crosshatch.
 - c. Humidity Resistance: ASTM D 4585.
 - d. Salt Spray (Fog): ASTM B 117.
7. Finish coat shall meet or exceed the following performance criteria:
 - a. Abrasion: ASTM D 4060, CS17 Wheel, 1,000 gram load.
 - b. Adhesion: ASTM D 3359, Method B, 5 mm crosshatch.

- c. Graffiti Resistance: After drying for seven days, no staining from acrylic, epoxy, epoxy-ester and alkyd spray paints, ballpoint pen, crayons, magic marker, black shoe polish and lipstick.
- d. Weathering: ASTM D 1014, 45 degrees facing south.
- e. Surface Burning Characteristics: ASTM E 84
- f. QUV: ASTM G53, ES-40 bulbs, 4 hours light, 4 hours dark.
- g. Salt Spray (Fog): ASTM B 117.

8. Clearcoat over finish coat shall meet or exceed the following performance criteria:

- a. Abrasion: ASTM D 4060, CS17 Wheel, 1,000 gram load.
- b. Adhesion: ASTM D 3359, Method B, 5 mm crosshatch.
- c. Graffiti Resistance: After drying for seven days, no staining from acrylic, epoxy, epoxy-ester and alkyd spray paints, ballpoint pen, crayons, magic marker, black shoe polish and lipstick.
- d. Weathering: ASTM D 1014, 45 degrees facing south; and ASTM D 4141C EMMAQUA-NTW.
- e. QUV: ASTM G53, ES-40 bulbs, 4 hours light, 4 hours dark.
- f. Salt Spray (Fog): ASTM B 117.
- g. Flexibility: ASTM D 522, Method B, cylindrical mandrel.
- h. Hardness: ASTM D 3363 (Pencil).

PART 3 - EXECUTION

0.1 EXAMINATION

- A.** Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements. Elevations shall be verified by a surveyor licensed in the Commonwealth of Massachusetts.
- B.** Proceed with installation only after unsatisfactory conditions have been corrected.

0.2 PREPARATION

- A.** Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

0.3 ERECTION

- A.** Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".

B. **Base and Bearing Plates:** Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten or pretension anchor rods as applicable after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. **Shear Connectors:** Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

0.4 FIELD CONNECTIONS

- A.** High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint indicated on the Drawings.
- B.** Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
 - c. Re-profile all steel surfaces (using needle guns or other profiling methods) that have been welded and ground smooth to assure proper adhesion of primers and topcoats.

0.5 FIELD QUALITY CONTROL

- A.** Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B.** Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts". When using bolted connections prime with "slip critical class B" primer as specified in this Section. All surfaces of bolted or bearing connections may be primed. When welding, hold back primer a minimum of 2 inches each side of weld.
- C.** Welded Connections: Field welds will be visually inspected according to AWS D1.1. In addition to visual inspection, specialty tests will be performed in accordance with AWS D1.1 and at the frequency stated in Article 1.5.F.5

- D.** In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E.** Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

0.6 REPAIRS AND PROTECTION

- A.** Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B.** Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

PART 4 - MEASUREMENT AND PAYMENT

0.1 MEASUREMENT

- A.** The items below will be measured per pound complete in place, including all accessories and incidentals.
- B.** Only structural steel incorporated into the completed work will be measured for payment under this section. Temporary supports, jigs, jacking frames, blocking, or any other temporary device or structure which the Contractor finds necessary to safely construct the work will not be measured separately for payment.
- C.** Structural steel will be measured by the pound, calculated without deduction for holes under 12 inches longest dimension, for each item, and type, complete and in place, regardless of material grade. Measurement shall be based only on computed masses of steel complete in place in the structure. No additional allowance in mass shall be made for the shop coat of paint or any coat of paint or other protective coating. The mass of the rolled shapes and of the plates, regardless of the width of the plates, shall

be computed on the basis of their nominal mass and of their dimensions as shown on the approved shop drawings, deducting for copes and cuts, and for all open holes that are not filled with rivets, bolts or plug welded.

- D.** Stud shear connectors affixed to steel will not be measured separately for payment, but all costs in connection therewith will be considered incidental to the applicable items of structural steel work.
- E.** Shims, wedges, fasteners, metallic coating, and setting bearing plates including dry packing, will not be measured separately for payment, but all costs in connection therewith will be considered incidental to the applicable items of structural steel work. Fasteners shall include the weight associated with the bolted connections, including all washers and nuts.
- F.** Drilling, welding, and all other work associated connections and erection, whether performed in the shop or in the field will not be measured separately for payment, but all cost in connection therewith will be considered incidental to the work to which it pertains. Computed weights shall not include the weight of welds.

0.2 PAYMENT

- A.** Payment for the items below will be made at the Contract unit price for the measurement as specified above.

0.3 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
0510.350	STRUCTURAL STEEL	LB

END OF SECTION

NOTES TO THE DESIGNER

- A.** Any request to modify or waive the specification requirements listed below must be approved in writing by the MBTA's Director of Design:
 - 1. Where structural tubing is specified, the required corrosion protection is shop hot-dip galvanizing.
 - 2. A325 bolts are required for all high strength bolting.
- B.** Depending on the type of structure to be built, select the proper AISC Certification (See Article 1.5.A). If contract includes bridge work or metal buildings, assign the appropriate AISC Certification Category.